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(54) [Title of Invention]
Musical Instrument String
(57) [Abstract]
[Purpose] An object is to provide a string for musical instruments keeping acoustic characteristics of a string while being able to maintain an aesthetic appearance for a long term.
[Structure] A low tone string for pianos 10 is a wound string formed by winding a core wire 3 with a coated cupper wire 5. The coated cupper wire 5 consists of a soft cupper wire for pianos 5a of highly purified cupper, hard resin film 5b of 3μm film thickness which coats the outer circumferential surface of the soft cupper wire for pianos 5a. The hard resin film 5b is made of polyurethane. In this connection, a music wire of high carbon steel for a piano string is employed for the core string 3. Comparing the low tone piano string 10 with a conventional piano string 40, little difference between their acoustic characteristics were observed, and the appearance of this invention is not changed with time and able to maintain a metallic gloss of cupper.

[Claim]

[Claim 1]

A string for musical instruments characterized in that a core wire is wound with cupper wire coated with transparent hard resin film having film thickness of 2-6μm.

[Brief Explanation of Drawings]

[Fig. 1] A drawing for explanation of the first embodiment, where (A) is its front view; (B), a sectional view of (A) taken from A-A.

[Fig. 2] A graph showing the relation between hard resin film materials and internal losses.

[Fig. 3] A graph showing the relation between thickness of hard resin films and sound volumes.

[Fig. 4] A graph showing the relation between thickness of hard resin films and internal losses.

[Explanation of Reference numerals]

10, 20, 30, 40 --- Low tone string for pianos; 3 --- Core wire; 5 --- Coated cupper wire; 5a --- Soft cupper wire for pianos; 5b --- Hard resin film

[Detailed Explanation of Invention]

[0001]

[Industrial Field]

This invention relates to strings for musical instruments, consisting of a core wire wound with cupper wire.

[0002]

So far, strings consisting of a core wire wound with cupper wire are used as strings for musical instruments such as pianos, guitars, in order to generate low tone. Such strings for musical instruments consisting of a core wire wound with cupper wire have a beautiful metallic gloss of cupper at the beginning.

[0003]

[Problems to be Solved by Invention]

However, there are shortcomings: a metallic gloss of cupper as described above is turned into dark brown and/or verdigrised due to contact with air, and aesthetic appearances of strings are lost. Especially for grand pianos in which the appearances of strings are visible in the appearances of the instruments, it is worried that there is a risk that these appearance changes would loose the feeling of high grade.

[0004]

Further, as cupper surfaces of musical instrument strings change qualitatively, acoustic characteristics are often deteriorated in comparison with those of a fresh string.

In order to solve the above-mentioned problems, an object of this invention is to provide a string for musical instruments keeping acoustic characteristics of a string while being able to maintain an aesthetic appearance for a long term.

[0005]

[Means for Attaining Object and Actions]

In order to attain the above-mentioned object, the strings for musical instruments according to this invention are formed by winding a core wire with cupper wire coated with transparent hard resin film having film thickness of 2-6μm.

For a hard resin film, for instance, polyester, polyurethane, etc. may be used, though not limited to these materials. Among these materials, polyester is preferable in view of acoustic characteristics. This is because, as shown in Fig. 2, in the relation between film thickness and internal loss, although the internal loss increases along with the increase of the film thickness, the rate of the increase of polyester is lower and thus the possibility that polyester exerts a bad influence on the acoustic characteristics is low. In this connection, types, kinds, etc. of polyesters and polyurethanes are not limited as long as those are usually known.

[0006]

In this invention, the thickness of hard resin film should be 2-6 μm. A film with thickness of less than 2 μm could not sufficiently prevent the color change and corrosion of cupper, or the duration of preventing the color change and corrosion of cupper would be short. On the other hand, a film with thickness of more than 6 μm increases the internal loss, exerting a bad influence on the acoustic characteristics.

[0007]

In the strings for musical instruments according to this invention, by coating cupper wire with transparent hard resin film having thickness of 2-6 μm, the contact between the cupper wire and air is avoided, and thereby preventing the deterioration of the aesthetic appearances of the strings due to the color change and corrosion of cupper, and the metallic gloss of cupper at the beginning can be maintained for a long term. Simultaneously, since the internal loss of hard resin film is suppressed low by limiting the thickness of film into 2-6 μm, acoustic characteristics for musical instruments are little affected.

[0008]

[Embodiment]

In the following, embodiments of this invention will be explained based upon the drawings.

The first embodiment is a low tone string for pianos according to this invention, and Fig. 1(A) is its front view; Fig. 1(B) is a sectional view of Fig. 1 (A), taken along A-A.

[0009]

A low tone string for pianos 10 of this embodiment is a wound string formed by winding a core wire 3 with a coated cupper 5. The coated wire 5 consists of a soft cupper wire for pianos 5a, made of highly purified cupper with a diameter of 0.25-2.0 mm, and a hard resin film 5b with thickness of 3 μm coating the outer circumferential surface of the soft cupper wire for pianos 5a. Further, for the core string 3, a musical wire of high carbon steel for piano string with diameter of 1-1.5 μm was used. In this connection, for the hard resin film, polyurethane with pencil hardness of 5-6 H was used.

[0010]

The coated cupper wire 5 used in this embodiment, for instance, can be obtained as follows:

Firstly, a solution, prepared by heating polyurethane for a source material of hard resin film 5b and a diluting solution, is applied or blown onto the outer circumferential surface of the soft cupper wire for pianos 5a, or the soft cupper wire for pianos 5a is dipped in the solution. Then, the soft cupper wire for pianos 5a is dried, and thereby

hard resin film 5b is formed on the outer circumferential surface of the wire. By repeating this process, the thickness of film is adjusted to 3 μm, and then a coated cupper wire 5 is obtained.

[0011]

In the second embodiment, a low tone string for pianos 20 with thickness of 6 μm was prepared similarly as in the first embodiment.

Further, for the first comparative sample, a low tone string for pianos 30 with thickness of 30 μm was prepared similarly as in the first embodiment.

[0012]

Moreover, for the second comparative sample, a common low tone string for pianos 40 was prepared, which string consisted of structures similar to the low tone string for pianos 10 except that a soft cupper wire 5a was used instead of the coated cupper wire of the first embodiment.

Hereinafter, there will be shown test results of comparing acoustic characteristics, etc. of the low tone strings for pianos 10, 20 of the respective embodiments and the low tone strings for pianos 30, 40 of the respective comparative samples.

[Test Example 1]

Volumes of the low tone strings for pianos 10, 20 of the respective embodiments and the low tone string for pianos 30 of the first comparative sample were measured, where the volume of the low tone string for pianos 40 was used for the reference value (0dB). The results are shown in Fig. 3.

[0013]

As is seen from Fig. 3, the effect of the thickness of hard resin film on volume increased in the higher pitch range. In the case of the low tone string for pianos 20 with thickness of 6 μm, however, the effect of the thickness was practically insignificant even in the high pitch range (4 kHz). In the case of the low tone string for pianos 30 with thickness of 30 μm, on the other hand, especially in the high pitch range, the effect of the thickness was at an extent of hindering practical use of the string. These results suggest that it is highly possible that a film with thickness of more than 6 μm exerts a bad influence on sound volume of a string.

[Test Example 2]

The relation between pitch range and internal loss was investigated with respect to the low tone strings for pianos 10, 20 of the respective embodiments and the low tone string for pianos 30 of the first comparative sample, where the internal loss of the common low tone string for pianos 40 was used for the reference value (0 %), and then the graphs shown in Fig. 4 were obtained. In this connection, an internal loss closely relates to an

attenuation ratio: an attenuation ratio increases with the increase of an internal loss. Further, in order to avoid a bad influence on an attenuation ratio practically, it is required to prevent the value of an internal loss from exceeding 5 %.

[0014]

As is seen from Fig. 4, the effect of the thickness of hard resin film on internal loss increased in the higher pitch range, and in the case of the low tone string for pianos 20 with thickness of 6 μm, the internal loss reached to about 5 % in the high pitch range (4 kHz). Thus, it was anticipated that an internal loss exceeded 5% when a film thickness exceeds 6 μm so that the upper limit value of the film thickness was judged 6 μm.

[0015]

In the case of the low tone string for pianos 30 with thickness of 30 μm, on the other hand, the internal loss of more than 5 % was observed in the pitch range of 250 Hz – 4 kHz, resulting in that this sample would exert a bad influence on an attenuation ratio practically.

[Test Example 3]

With respect to the low tone strings for pianos 10, 20 of the respective embodiments and the low tone strings for pianos 30, 40 of the respective comparative samples, outdoor exposure tests were executed and the appearance changes of the strings with time were monitored. The results are shown in Table 1.

[0016]

[Table 1]

<Appearance Change with Time in Outdoor Exposure Test>

	Low Tone Strings 10	Low Tone Strings 20	Low Tone Strings 30	Low Tone Strings 40
One week exposure	No Change	No Change	No Change	Turn into Dark Brown

[0017]

As is seen from Table 1, while the common low tone string for pianos 40 turned dark brown one week later, the low tone strings for pianos 10, 20, 30 kept metallic gloss of cupper for a long term and maintained aesthetic appearances. In this connection, a low tone string for pianos having hard resin film with thickness of less than 2 μm was also prepared similarly as in the first embodiment, but in which string, pinholes, etc. were easily formed on the resin film so that parts turning dark brown were observed and the aesthetic appearance was not maintained. Thus, the lower limit value of the

film thickness was judged 2 μm.

[0018]

Moreover, similar tests were executed for low tone strings for pianos obtained similarly as in the first embodiment except that the material of the hard resin film was polyester instead of polyurethane, and then, similar or better results were obtained. Since the increment of the internal loss of polyester when the film thickness increase is small (See Fig. 2), the effects on the acoustic characteristics are smaller.

[0019]

From the test examples 1-3, in order to keep a metallic gloss of cupper for a long term and to maintain an aesthetic appearance on a string, it is required that the thickness of hard resin film is more than 2 μm, and in order to maintain acoustic characteristics equal to those of a conventional low tone string for pianos, it is required that the thickness of the hard resin film is no more than 6 μm.

[0020]

This invention is not limited to the above-described embodiments, and the invention may be embodied in various ways without deviating from the scope of the invention. For instance, while the embodiments described here are low tone strings for pianos, the strings may be used for guitars and other stringed instruments.

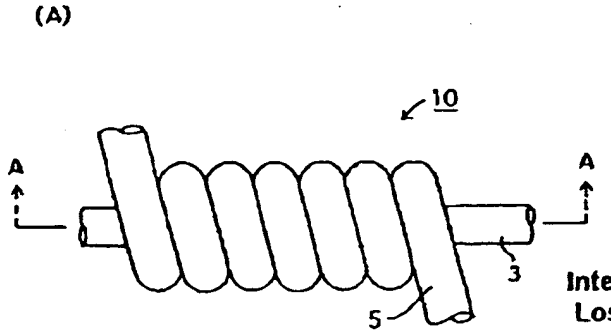
[0021]

[Effects of Invention]

As described above, according to the musical strings of this invention, the acoustic characteristics of strings are kept while those aesthetic appearances are maintained for a long term. As a result, in the case of grand pianos in which the appearances of strings are visible in the appearances of the instruments, for instance, the deterioration of these appearances due to the color change and corrosion of strings are avoided, and thereby the feeling of high grade is maintained.

【図１】

Fig. 1

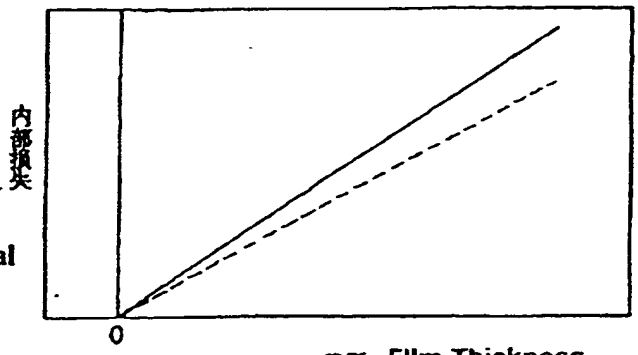


【図２】

Fig. 2

Relation between Hard Resin Film Material and Internal Loss

硬質樹脂膜素材と内部損失の関係

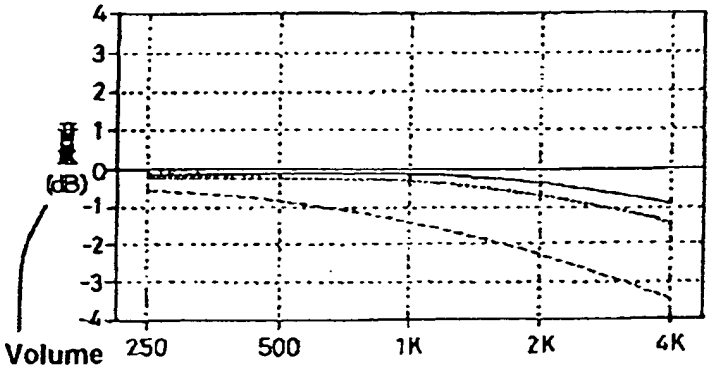


【図３】

Fig. 3

Relation between Film Thickness and Sound Volume

膜厚と音量の関係



【図４】

Fig. 4

Relation between Film Thickness and Internal Loss

膜厚と内部損失の関係